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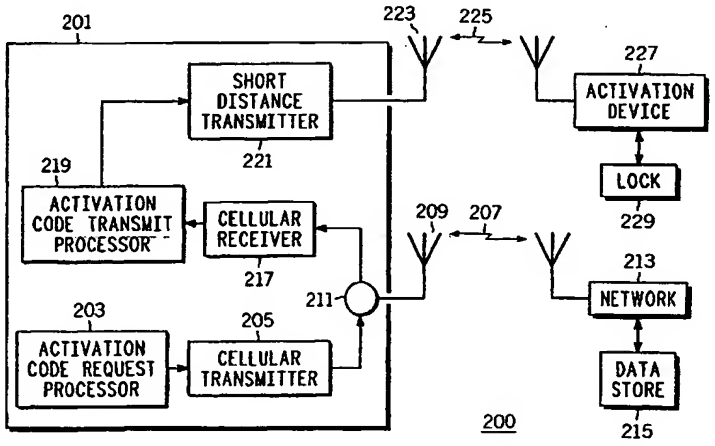
(54) Title: A COMMUNICATION DEVICE AN ACTIVATION DEVICE AND METHOD OF SECURE ACTIVATION THEREFOR



(57) Abstract: This invention relates to a system (200) for activation of an activation device (227) such as a lock (229). A communication device (201) comprises means (203,205) for communicating an activation request message to a network (213) over a first air interface (207) such as a cellular air interface. The activation request message comprises information related to the identity of the communication device (201) and information related to the identity of the activation device (227). It further comprises means (217) for receiving an activation code for the activation device over the first air interface with the activation code being dependent on the information comprised in the activation request message. It also comprises means (210,221) for communicating the activation code from the communication device (201) to the activation device (227) over a second air interface (225). The activation device (227) comprises means for receiving the activation code from the communication device and means for performing a required activation in response to this.

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

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A COMMUNICATION DEVICE, AN ACTIVATION DEVICE AND METHOD OF SECURE ACTIVATION THEREFOR

Field of the Invention

This invention relates to a communication device, an activation device and method of secure activation therefor, and in particular to a system of activating an access control activation device such as a lock.

Background of the Invention

It is well known today to use wireless interfaces to control and activate remote objects. A typical example is the ubiquitous infrared remote control which is well known as a device for controlling electronic devices such as televisions, radios etc.

Wireless activations are also known for other applications such as for operating access mechanisms and locks. One example is a car door opener which activates the door lock when a button is pressed on a radio or infra red transmitting device. The signal transmitted by the transmitting device is specific for the specific car thereby preventing unauthorised access.

The wireless activations and key systems improve on more traditional key systems which typically require a mechanical key for each separate lock or activation device. The traditional key systems have a number of disadvantages including the following

- heavy to carry
- exposed to loss and theft.
- almost no security is given in case of loss and copies can be made easily
- high costs are caused by replacing locks and keys
- Keys can get worn-out and become non-functional

- The distribution of keys to e.g. family members or employees is expensive and inflexible
- Difficult to implement a smart access system for houses or companies (restricted access)

Another known mechanism of secure activation of devices such as locks etc are by using magnetic cards or swipe cards. However, these systems have the disadvantages of:

- Cards being expensive and time consuming to produce
- Card reader being unreliable and error prone
- If changing access codes new cards for everybody have to be reissued
- A loss of a card means issuing a new one, which causes additional costs

A different known method of securely activating devices is by using an access codes which are entered on a keypad by a user. However, disadvantages of this approach include:

- if somebody finds out the code then accessing/opening the device is easy
- it is inconvenient for users to remember the access codes
- in order to make a code easy to remember and practical to key in every time the device is to be activated, it must be relatively short. However, a short code results in low security.

Although known wireless activation devices such as a car door opener improve on many of the disadvantages of these other systems, they also maintain a number of the disadvantages, including

- dedicated control devices are required for each activation device or group of activation devices
- the system is inflexible requiring that control device and activation device are configured to work directly with each other. Typically, the access code is pre-

programmed into both control device and activation device, and modification is impossible or at least require manual re-configuration of individual devices.

- Replacement after loss difficult and time consuming and distribution of additional activation keys limited or impossible
- Limited security– access can't be blocked immediately if access key gets stolen

There is thus a need for an improved system of secure activation of devices.

Summary of the Invention

The invention seeks to provide an improved system for secure activation of devices.

Accordingly there is provided, a method of secure activation of an activation device; comprising the steps of: communicating an activation code request message from a communication device to a network over a first air interface; the activation code request message comprising information related to an identity associated with the communication device and to the identity of the activation device; deriving an activation code for the activation device by accessing a data store associated with the network in response to the information comprised in the activation code request message; communicating the activation code from the data store to the communication device through the network and over the first air interface; communicating the activation code from the communication device to the activation device over a second air interface; and the activation device performing a required activation in response to receiving the activation code from the communication device.

Preferably, the activation request message further comprises information identifying the required activation and the activation device is operable to perform a plurality of activations and the activation code identifies the required activation.

According to a feature of the invention, the method further comprises the step of determining a set of accessible activation devices accessible by the communication device.

Preferably, the first air interface is part of a cellular radio communication system; the communication device is a mobile terminal of the cellular communication system and the second air interface is a short distance air interface.

In accordance with a second aspect of the invention, there is provided a communication device for secure activation of an activation device comprising: means for communicating a activation request message to a network over a first air interface; the activation request message comprising information related to the identity of the communication device and information related to the identity of the activation device; means for receiving an activation code for the activation device over the first air interface; said activation code being dependent on the information comprised in the activation request message; and means for communicating the activation code from the communication device to the activation device over a second air interface.

In accordance with a third aspect of the invention, there is provided an activation device comprising: means for receiving a probe message from a communication device over an air interface; means for transmitting an identification message from the activation device to the communication device over the air interface; means for receiving an activation code from the communication device over the air interface; and means for performing a required activation in response to receiving the activation code from the communication device.

Brief Description of the Drawings

An embodiment of the present invention is described below, by way of example only, with reference to the Drawings, in which:

FIG. 1 is an illustration of a cellular communication system according to prior art;

FIG. 2 is an illustration of a system of activation and a communication device for activation in accordance with an embodiment of the invention; and

FIG. 3 is an illustration of a flow chart of a method of activation in accordance with an embodiment of the invention.

Detailed Description of a Preferred Embodiment

In the preferred embodiment the activation is a secure activation and in particular a secure activation of an access control activation device.

The following description focuses on an embodiment compliant with a cellular communication system but it will be apparent that the invention is not limited to this application.

In a cellular communication system, each of the user equipment or subscriber units (mobile stations, user terminals etc) communicates with typically a fixed base station. Communication from the subscriber unit to the base station is known as uplink and communication from the base station to the subscriber unit is known as downlink. The total coverage area of the system is divided into a number of separate cells, each predominantly covered by a single base station. The cells are typically geographically

distinct with an overlapping coverage area with neighbouring cells. FIG. 1 illustrates a cellular communication system 100. In the system, a base station 101 communicates with a number of subscriber units 103 over radio channels 105. In the cellular system, the base station 101 covers users within a certain geographical area 107, whereas other base stations 113, 115 cover other geographical areas 109, 111. Some overlap areas can be covered by more than one cell.

As a subscriber unit moves from the coverage area of one cell to the coverage area of another cell, the communication link will change from being between the subscriber unit and the base station of the first cell, to being between the subscriber unit and the base station of the second cell. This is known as a handover. Specifically, some cells may lie completely within the coverage of other larger cells.

All base stations are interconnected by a fixed network. This fixed network comprises communication lines, switches, interfaces to other communication networks and various controllers required for operating the network. The base stations themselves can also be considered part of the fixed network. A call from a subscriber unit is routed through the fixed network to the destination specific for this call. If the call is between two subscriber units of the same communication system the call will be routed through the fixed network to the base station of the cell in which the other subscriber unit currently is. A connection is thus established between the two serving cells through the fixed network. Alternatively, if the call is between a subscriber unit and a telephone connected to the Public Switched Telephone Network (PSTN) the call is routed from the serving base station to the interface between the cellular mobile communication system and the PSTN. It is then routed from the interface to the telephone by the PSTN.

FIG. 2 illustrates a system 200 of activation and a communication device such as a subscriber unit 201 for activation in accordance with an embodiment of the invention.

The communication device comprises an activation code request processor 203 connected to a cellular transmitter 205 operable to communicate in cellular communication system over a radio link 207. The transmitter 205 is coupled to an antenna 209 through a duplexer 211 operable to allow a receiver 217 and a transmitter 205 to use the same antenna 209, as is well known in the art. The communication device 201 communicates with the network 213 over a first air interface which in the embodiment consists in a cellular radio link 207. The network 213 comprises base stations, base station controllers, master switch centres; routers and any other component required or desired in the implementation of a cellular communication system. The network 213 is connected to a data store 215 that for clarity is shown as an independent unit in FIG. 2 but which may be implemented in any suitable form and specifically may be implemented as part of an existing network component. In alternative embodiments, the network 213 shown may be a very simple network. In its simplest form, it may simply consist in interface circuitry for interfacing with the data store and a transceiver suitable for communicating with the communication device over the first air interface.

The communication device further comprises a cellular receiver 217 connected to the duplexer 211. The cellular receiver 217 is operable to receive signals sent from the network 213 to the communication device 201. The cellular receiver 217 is connected to an activation code transmit processor 219 connected to a short distance transmitter 221. The short distance transmitter 221 is connected to an antenna 223 for communication over a second air interface 225, which in this embodiment is a short distance radio interface. Short distance air interfaces have a range of a few hundred meters or less and examples include the Bluetooth, Hiperlan or WiFi standards well known in the art. However, any second air interface may be used including for example wireless infrared communication links. The communication device 201 communicates with an activation device 227 over the second air interface 225. In the shown embodiment, the activation device is connected to an external mechanical lock 229 which is activated by the activation device 227. In other embodiments, the

activation device 227 may activate other devices or the activation may be of the activation device 227 itself. The activation may further be of part of a device, of a specific function of the device or of any other suitable component or function.

FIG. 3 is an illustration of a flow chart of a method of activation in accordance with an embodiment of the invention.

In step 301 the activation code request processor 203 generates and transmits an activation code request message. This message comprises the information needed to identify the communication device as well as the activation device. Specifically, it may contain a specific number uniquely identifying the communication device and a second number uniquely identifying the activation device. Any suitable format and protocol can be used for generating an activation code request message provided it contains information related to an identity associated with the communication device 201 and information related to the identity of the activation device 227.

Specifically, the information related to an identity associated with the communication device 201 can in the preferred embodiment, where the communication device 201 is a user equipment of a cellular communication system (e.g. a mobile phone), for example be a unique identity pre-programmed into the user equipment (such as the International Mobile Equipment Identity (IMEI) number for GSM), a subscriber identity (such as the International Mobile Subscriber Identity (IMSI) for GSM) or a dynamic identity allocated to the communication device (such as the Temporary Mobile Subscriber Identity (TMSI) for GSM). Specifically when a subscriber identity is used, this can beneficially be stored in a removable storage media, such as a smart card or the SIM card in GSM. This provides the added advantage that different communication devices can operate the system of activation simply by moving the removable storage media from one device to another.

The information relating to the identity of the activation device is preferably a unique identity of the device such as a specific serial number. However, in some embodiments it may also be a group identity or a device type identity. In these embodiments, the system may be utilised to activate a plurality of activation devices simultaneously. Alternatively, a user may have permission to activate all activation devices in a certain group or of a certain type and by using the identity of this group or type in the activation code request message, the user will receive and activation code suitable for all devices in the group or of the type. This can be used to activate the specific device in the vicinity of the user.

The cellular transmitter 205 transmits the activation code request message to the network 213.

Upon receiving the activation code request message, the network 213 in step 303 proceeds to derive an activation code for the activation device. This is achieved by accessing the data store 215. In the simplest form the data store comprises a simple data structure wherein for each activation device identity, there is a corresponding activation code and list of allowed communication device identities. Alternatively and/or additionally, a data structure may be implemented wherein for each communication device identity there is a list of allowed activation devices with their corresponding activation code. It will be clear that any suitable organisation, association or structuring of the data allowing an activation code being determined in response to the information comprised in the activation code request message, can be used.

If the information in the data store does not have an association between the communication device identity and the activation device identity, no access code will be returned or alternatively a void access code is returned indicating that no such association exist. This void access code may be used by the communication device to

cease the operation or if processed as a normal access code and transmitted to the activation device, it will fail to activate the activation device.

In step 305, the derived activation code is transmitted from the network to the communication device over the first air interface. In the preferred embodiment, it is thus transmitted using the cellular transmission protocol of the cellular communication system. In a GSM communication system the General Packet Radio Service (GPRS) is advantageous as it is an efficient method for communication of small data packets.

The activation code is received by the communication device 201 and fed to the activation code transmit processor 219. This processor controls a second transmitter 221 operable to communicate over the second air interface. Hence, in step 307 the short distance transmitter 221 transmits the activation code to the activation device 227 over the second air interface 223. In the simplest embodiment the access code is transmitted directly as received from the data store but in other embodiments it is modified by the activation code transmit processor 219 or additional information is appended to the message (such as e.g. the terminal or subscriber identity). Also further commands or requests may be included allowing the communication device to control different functions of the activation device 227 based on the same access code.

When receiving the activation code, the activation device 227 checks that it is a valid access code and if so, it proceeds in step 309 by performing the required action. In the described embodiment this results in the activation device 227 activating the mechanical lock 229 thereby locking or unlocking e.g. a door.

In the simple embodiment described only one access code exists for each activation device. However, in more advanced embodiments each activation device may be operable to perform a plurality of activations. In this embodiment different activation codes are used for different activations and the activation code request message further comprises information identifying the required activation. The data store will

consequently not only have associations between the communication device identity, the activation device identity and the appropriate access code but also between the information identifying the required activation and the appropriate access code. Hence, in this embodiment an activation device capable of the functions of locking a door, unlocking a door, switching a light on and switching a light off may be operated by the activation code request processor 203 of the communication device including an identification of the required action in the activation request message. The message may thus contain the appropriate code for the function "unlock the door". This is used by the data store to identify the appropriate access code corresponding to the communication device identity, the activation device identity and the function of opening the door. This access code is then transmitted to the communication device and then to the activation device which will detect that this is the appropriate access code for this function and consequently unlock the door.

In the preferred embodiment, the identity of the activation device is simply entered into the communication device by the user. Preferably, the identity is stored in a non-volatile memory so that it needs only be entered once, i.e. the first time the user uses the activation device. From then on, the activation device can be chosen from a customised list contained in the communication device.

However, in a more advanced embodiment the communication device scans for available activation devices using the short distance air interface. In this embodiment, the communication device transmits a probe message over the second air interface. This probe message is received by all activation devices within the transmission area of the communication device (typically limited to a few hundred meters or less for the short distance air interface of the preferred embodiment). Upon receiving a probe message, the activation device transmits an identification message on the second air interface. This identification message is received by the communication device and comprises information relating to the identity of the activation device. It may comprise further information relating to the for example the type, location or functionality of the

activation device. The information is used to select which activation devices are accessible and to select which to activate, in the preferred embodiment simply by the user selecting from a displayed list of all accessible activation devices. The information is further supplied to the activation code request processor 203 which uses it when generating the access code request message.

In one scenario, it is possible that a plurality of target devices are in the close vicinity of a communication device and therefore more than one activation device could be potential targets for the command. In one embodiment for this scenario, an access method is used to select which target device to execute the command on. The access method comprises selecting the appropriate activation device in response to the users environment. An example would be that if a user sits in his/her running locked car and presses the "open" button the access method determines that it doesn't make sense to open the car, but opens the garage door instead. The access method can be extended to take into account known user patterns. If the communication device still doesn't manage to make a safe decision on the target, it displays a list of targets for selection from the user.

In a different embodiment the associations between identity information and activation codes in the data store are modified in response to a user input preferably by changing all associations related to an identity associated with the communication device to an identity associated with a different communication device.

This feature is particularly beneficial for preventing or changing the access of an unauthorised communication device. For example, if a communication device is lost or stolen, all the keys belonging to the communication identity can be passed on to a new communication device by changing the associations in the data store from referring to the identity of the stolen communication device to that of the new communication identity. This provides a very easy and simply process for both barring the stolen or lost communication device as well as for enabling the new device.

The embodiments described thus enable the user to use a communication device such as a mobile phone for locking and unlocking any device (like cars, doors, safes, suitcases, lockers, letterboxes etc) with an electronic wireless access system. "Cutting a new key" is as simple as typing once a few numbers into the mobile. The system is very reliable and highly secure against misuse and in case of loss of the mobile phone and/or replacement with a new mobile phone all keys are easily replaced or transferred. The embodiments also allow in an easy way to set up smart access systems in houses and companies implementing restricted access for individuals or groups.

The components and functionality described may be implemented in any suitable manner to provide suitable apparatus. Specifically, the components may consist of a single discrete entity, or may alternatively be formed by adapting existing parts or components. As such the required adaptation may be implemented in the form of processor-implementable instructions stored on a storage medium, such as a floppy disk, hard disk, PROM, RAM or any combination of these or other storage media. Furthermore, the functionality may be implemented in the form of hardware, firmware, software, or any combination of these.

It will be understood that the invention tends to provide in particular the following advantages singly or in any combination:

- a low cost activation system can be implemented. This uses a communication device operable operate over a first interface, such as a cellular interface, to access a data store. The communication device may in addition be able to support other communications over this interface such as specifically phone calls. At the same time activation devices are accessed over a second air interface which can be a simple low cost air interface, such as Bluetooth, resulting in very little cost being added to the activation device.

- a high level of security is obtained as the access codes are centrally maintained.
- one device can be used for accessing a plurality activation devices and functions.
- automatic detection of accessible activation devices is possible.

Claims

1. A method of secure activation of an activation device; comprising the steps of:

communicating an activation code request message from a communication device to a network over a first air interface; the activation code request message comprising information related to an identity associated with the communication device and to the identity of the activation device;

deriving an activation code for the activation device by accessing a data store associated with the network in response to the information comprised in the activation code request message;

communicating the activation code from the data store to the communication device through the network and over the first air interface;

communicating the activation code from the communication device to the activation device over a second air interface; and

the activation device performing a required activation in response to receiving the activation code from the communication device.

2. A method as claimed in claim 1 wherein the activation request message further comprises information identifying the required activation.

3. A method as claimed in claim 1 or 2 wherein the activation device is operable to perform a plurality of activations and the activation code identifies the required activation.

4. A method as claimed in any previous claim further comprising the step of determining a set of accessible activation devices accessible by the communication device.

5. A method as claimed in claim as 4 wherein the step of determining a set of accessible activation devices comprising the step of the communication device transmitting a probe message over the second air interface and the activation device transmitting an identification message upon receiving the probe message

6. A method as claimed in any previous claim further comprising the steps of modifying at least some associations between identity information and activation codes in the data store in response to a user input.

7. A method as claimed in claim 6 wherein the step of modifying comprises changing all associations related to an identity associated with the communication device to an identity associated with a different communication device.

8. A method as claimed in any previous claim wherein the activation performed by the activation device is a locking or unlocking function.

9. A method as claimed in any previous claim wherein the first air interface is part of a cellular radio communication system.

10. A method as claimed in claim 9 wherein the communication device is a mobile terminal of the cellular communication system.

11. A method as claimed in claim 10 wherein the identity associated with the communication device is a terminal identity of the mobile terminal

12. A method as claimed in claim 10 wherein the identity associated with the communication device is a subscriber identity.

13. A method as claimed in claim 12 wherein the subscriber identity is contained in a removable storage media operable to interoperate with the communication device.

14. A method as claimed in any previous claim wherein the second air interface is a short distance air interface.

15. A communication device for secure activation of an activation device comprising:

means for communicating an activation request message to a network over a first air interface; the activation request message comprising information related to the identity of the communication device and information related to the identity of the activation device;

means for receiving an activation code for the activation device over the first air interface; said activation code being dependent on the information comprised in the activation request message; and

means for communicating the activation code from the communication device to the activation device over a second air interface.

16. A communication device claimed in claim 15 wherein the activation request message further comprises information identifying the required activation.

17. A communication device as claimed in any previous claim 15 to 16 further comprising means for determining a set of accessible activation devices accessible by the communication device.

18. A communication device as claimed in claim 17 wherein the means for determining a set of accessible activation devices comprises means transmitting a probe message over the second air interface and means for receiving an identification message from the activation device transmitting over the second air interface.

19. A communication device as claimed in any previous claim 15 to 18 wherein the first air interface is part of a cellular radio communication system.

20. A communication device as claimed in any previous claim 15 to 19 wherein the second air interface is a short distance air interface.

21. An activation device comprising:

means for receiving a probe message from a communication device over an air interface;

means for transmitting an identification message from the activation device to the communication device over the air interface;

means for receiving an activation code from the communication device over the air interface; and

means for performing a required activation in response to receiving the activation code from the communication device.

22. An activation device as claimed in claim 21 wherein the activation device is operable to perform a plurality of activations and is operable to determine the required activation in response to an identification comprised in the activation code.

23. An activation device as claimed in claim 21 or 22 wherein the activation performed by the activation device is a locking or unlocking function.

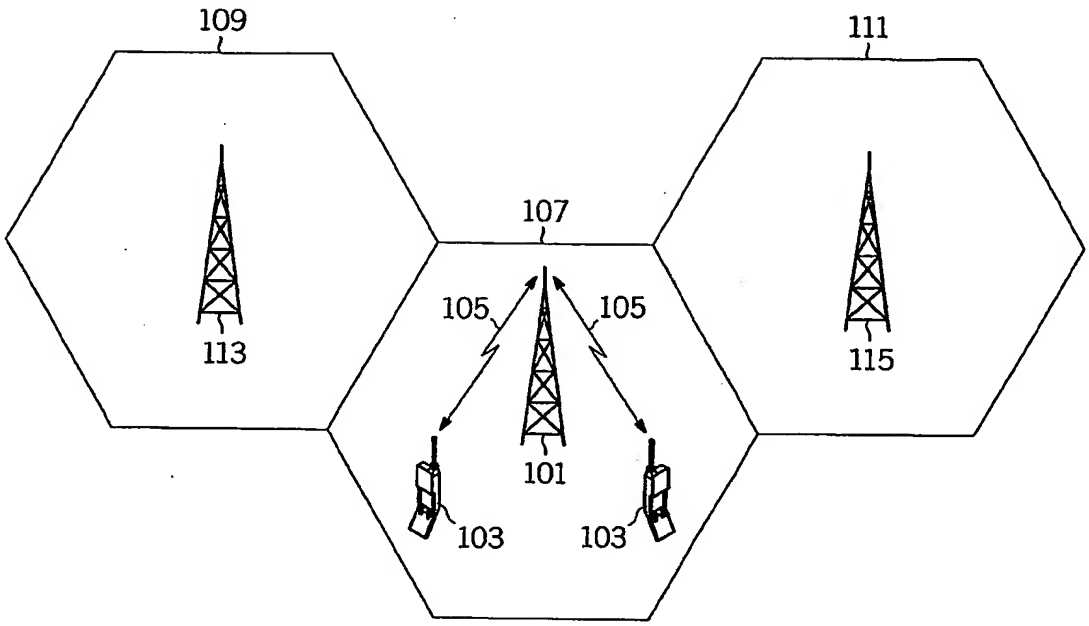

FIG. 1
-PRIOR ART-

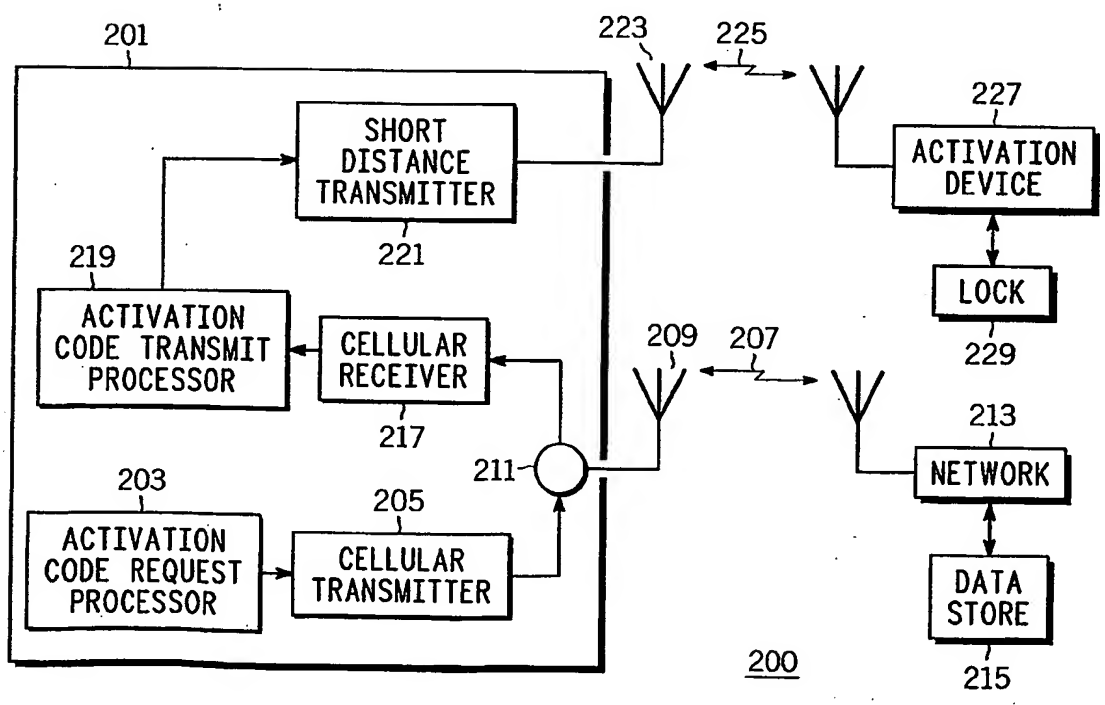

FIG. 2

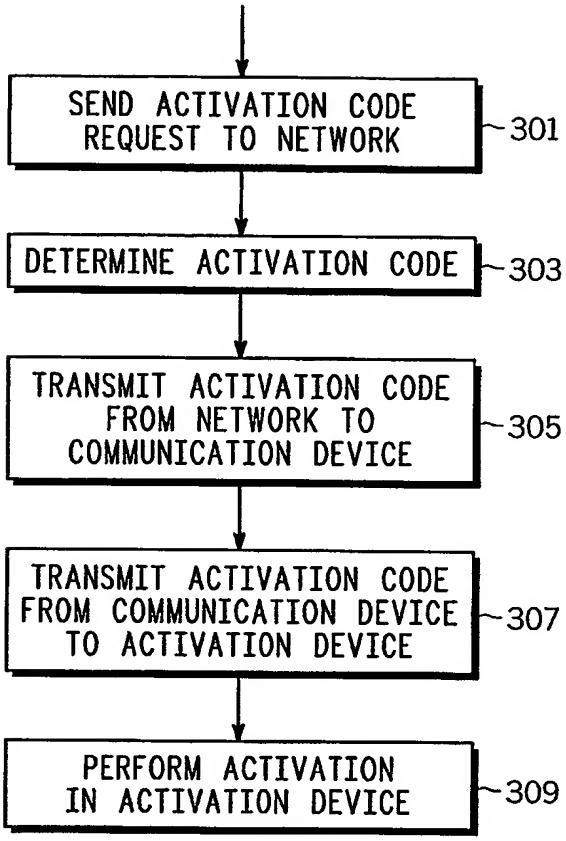
SEND ACTIVATION CODE REQUEST TO NETWORK
301
DETERMINE ACTIVATION CODE
303
TRANSMIT ACTIVATION CODE FROM NETWORK TO COMMUNICATION DEVICE
305
TRANSMIT ACTIVATION CODE FROM COMMUNICATION DEVICE TO ACTIVATION DEVICE
307
PERFORM ACTIVATION IN ACTIVATION DEVICE
309

FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 02/13030

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G07F7/10 G07C9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04M H04Q G07F G07C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 072 402 A (WELLS III RALPH H ET AL) 6 June 2000 (2000-06-06)	1-4, 6-17,19, 20
A	column 7, line 17 -column 8, line 2 figure 3	21-23
X	WO 98 58510 A (RITTER RUDOLF ;SWISSCOM AG (CH)) 23 December 1998 (1998-12-23) page 6, line 12 -page 10, line 28 page 11, line 22 -page 14, line 14 figures 1,2	1-4, 6-17,19, 20

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

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Date of the actual completion of the international search	Date of mailing of the international search report
8 May 2003	15/05/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Pacholec, D

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 02/13030

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